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Preface

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Engineering of Functional Interfaces

Dear colleagues,

On the following pages you will find a topical section with a series of 25 selected articles covering recent trends in the "Engineering of Functional Interfaces". Numerous device applications and a rich variety of fundamental phenomena originate right at solid–gas, solid–liquid, and solid–solid interfaces. To give just a few examples: metal–metal interfaces are present in magnetic read heads, semiconductor heterostructures are crucial in photovoltaics, electrode–liquid interfaces represent the heart of fuel cells and biosensors, and metal–gas interphases are essential in gas sensing and catalysis. To acknowledge the huge technological impact and the conceptual complexity of catalysis, Gerhard Ertl, the former director of the Fritz-Haber-Institute of the Max-Planck-Society in Berlin, was awarded the Nobel Prize in Chemistry of 2007 for his "studies of chemical processes on solid surfaces".

A short review on the physical principles behind heterogeneous catalysis by Dirk Rosenthal is therefore chosen as an overture of the topic "Interphases for gas sensing and catalysis". Next, the potential of interfaces for gas-sensing and vacuum-monitoring purposes is highlighted with metallic-, oxide-, and semiconductor-based surfaces. The preparation, electronic, and electrochemical properties of prospective sensor materials with high surface-to-volume ratio is described within the second section. A further important trend is also the integration and use of functional surfaces in the medical and biological sciences. Here, the third section is dedicated to specific adaptations of surfaces by polymer- and protein coatings allowing for applications in aqueous environments. For sensing experiments, like biological and chemical sensors, solid surfaces play a more and more advanced role, going beyond classical 'immobilization platforms' for receptors. Instead, the functionalized surface becomes an active element in signal generation and signal transduction such as in photonic (bio-) sensors or light-addressable potentiometric devices. Section 4, therefore gives an overview on various current evolutions in biosensing with solid-state based devices. The final section describes concepts to integrate sensors in multi-parameter analytical systems and parallelized electronic read-out strategies.

In conclusion, functional interfaces can be engineered to fullfil a broad range of demands and this topical issue puts, exemplarily, emphasis on sensing applications at solid–liquid and solid–gas interphases. The large 'toolbox' of microstructural and chemical surface modifications, novel hybrid- and nanomaterials, and the increasing understanding of the surface physics at the atomic scale make functional interfaces a fast growing domain. Many possible application routes are still waiting for exploration and this involves numerous interdisciplinary facets at the touching point of physics, chemistry, materials sciences, and life sciences.

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